

Appln. No.: 10/011,545
Amendment Dated May 31, 2005
Reply to Office Action of March 29, 2005

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Amendments to the Claims: This listing of claims will replace all prior versions, and listings, of claims in the application

Listing of Claims:

1. (Currently Amended) A method for displaying a predictively coded compressed video signal in a reverse time sequence comprising the steps of:

decoding and storing all I-frames and P-frames from a first group of pictures (GOP), exclusive of I and P frames from any other GOP, upon initiation of a reverse play command; and

after storing the decoded I-frames and P-frames from the first GOP, displaying video images from the first GOP in the reverse time sequence, including the steps of:

decoding any bidirectionally predictively encoded frames (B-frames) using the stored I-frames and P-frames and displaying the B-frames as they are decoded;

displaying the stored I-frames and P-frames of the first GOP as they are encountered in the reverse time sequence; and

while displaying the I-frames and the P-frames, decoding and storing respective I-frames and P-frames from a second GOP, exclusive of I and P frames from any other GOP, following the first GOP in the reverse time sequence;

wherein the display of frames from the first GOP begins prior to the decoding of any frame from the second GOP.

2. (Currently Amended) A method ~~according to claim 1 for displaying a predictively coded compressed video signal in a reverse time sequence comprising the steps of:~~

decoding and storing all I-frames and P-frames from a first group of pictures (GOP), exclusive of I and P frames from any other GOP, upon initiation of a reverse play command; and

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after storing the decoded I-frames and P-frames from the first GOP, displaying video images from the first GOP in the reverse time sequence, including the steps of:

decoding any bidirectionally predictively encoded frames (B-frames) using the stored I-frames and P-frames and displaying the B-frames as they are decoded;

displaying the stored I-frames and P-frames of the first GOP as they are encountered in the reverse time sequence; and

while displaying the I-frames and the P-frames, decoding and storing respective I-frames and P-frames from a second GOP, exclusive of I and P frames from any other GOP, following the first GOP in the reverse time sequence;

wherein:

the step of decoding and storing the I-frames and P-frames includes the step of downsampling the decoded I-frames and P-frames to produce respective downsampled I-frames and P-frames and storing the downsampled I-frames and P-frames;

the step of decoding the B-frames includes the step of filtering the decoded B-frames to display a reduced-resolution image; and

the step of displaying the I-frames and the P-frames includes the step of upsampling the stored I-frames and P-frames to provide respective reduced-resolution images for display.

3. (Previously Presented) A method according to claim 1, wherein the predictively coded compressed video signal is an MPEG compressed video signal and the steps of decoding I-frames and P-frames include the step of applying an MPEG decoding process.

4. (Currently Amended) A method for displaying an MPEG coded compressed video signal in a reverse time sequence comprising the steps of:

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retrieving a first group of pictures (GOP) upon initiation of a reverse play command, the retrieved first GOP being the GOP displayed immediately preceding the command;

decoding all I-frames and P-frames, exclusive of I and P frames from any other GOP, of the first GOP and storing them in a memory;

displaying the decoded I-frames and P-frames of the first GOP as the I-frames and P-frames are encountered in the reverse time sequence;

constructing and displaying any B frames of the first GOP as the B-frames are encountered in the reverse time sequence; and

decoding I-frames and P frames of a second GOP, exclusive of I and P frames from any other GOP, and storing the decoded I-frames and P-frames of the second GOP in the memory, the second GOP being a next preceding GOP, wherein each I-frame and P-frame of the second GOP is decoded while a respective one of the I-frames and P-frames of the first GOP is being displayed;

wherein the display of frames from the first GOP begins prior to the decoding of any frame from the second GOP.

5. (Previously Presented) A method according to claim 4 wherein:

the step of decoding and storing the I-frames and P-frames of the first GOP includes the step of downsampling the decoded I-frames and P-frames of the first GOP to produce downsampled key frames and storing the downsampled key frames;

the step of decoding the B-frames includes the step of filtering the decoded B-frames to display a reduced-resolution image; and

the step of displaying the I-frames and the P-frames includes the step of upsampling the stored I-frames and P-frames to display respective reduced-resolution images.

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6. (Currently Amended) Apparatus which displays a predictively coded compressed video signal in a reverse time sequence comprising:

a video decoder which decodes intra-coded frames (I-frames) and predictively coded frames (P-frames) from a first group of pictures (GOP), exclusive of I and P frames from any other GOP, upon initiation of a reverse play command;

a memory into which the video decoder stores the decoded I-frames and P-frames of the first GOP;

means for displaying a frame stored in memory while the I-frames and P-frames of the first GOP are decoded; and

a controller that controls the video decoder, the memory and the means for displaying such that, after the decoded I-frames and P-frames of the first GOP have been stored, the controller:

a) controls the video decoder to decode bidirectionally predictively encoded frames (B-frames) using the stored key frames and controls the means for displaying to display the B-frames as they are decoded;

b) controls the means for displaying to display the I-frames and P-frames from the memory as they are encountered in the reverse time sequence; and

c) controls the decoder and the memory to decode and store I-frames and P-frames from a second GOP, exclusive of I and P frames from any other GOP, following the first GOP in the reverse time sequence, while respective ones of the I-frames and P-frames of the first GOP are displayed; and

d) controls the means for displaying to begin displaying decoded frames from the first GOP before decoding any frame from the second GOP.

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7. (Currently Amended) Apparatus ~~according to claim 6 further including~~ which displays a predictively coded compressed video signal in a reverse time sequence comprising:

a video decoder which decodes intra-coded frames (I-frames) and predictively coded frames (P-frames) from a first group of pictures (GOP), exclusive of I and P frames from any other GOP, upon initiation of a reverse play command;

a filter, coupled to the decoder for generating respective reduced-resolution versions of the decoded I-frames, P-frames and B-frames; and

a downsampler which decimates the reduced-resolution versions of the decoded I-frames and P-frames before the I-frames and P-frames are stored in the memory.

a memory into which the video decoder stores the decoded and downsampled I-frames and P-frames of the first GOP;

means for displaying a frame stored in memory while the I-frames and P-frames of the first GOP are decoded; and

a controller that controls the video decoder, the memory and the means for displaying such that, after the decoded I-frames and P-frames of the first GOP have been stored, the controller:

a) controls the video decoder to decode bidirectionally predictively encoded frames (B-frames) using the stored key frames and controls the means for displaying to display the B-frames as they are decoded;

b) controls the means for displaying to display the I-frames and P-frames from the memory as they are encountered in the reverse time sequence;

c) controls the decoder and the memory to decode and store I-frames and P-frames from a second GOP, exclusive of I and P frames from any other GOP, following the first

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GOP in the reverse time sequence, while respective ones of the I-frames and P-frames of the first GOP are displayed.

8. (Currently Amended) Apparatus for displaying a predictively coded compressed video signal in a reverse time sequence comprising:

means for decoding and storing any I-frames and P-frames from a first group of pictures (GOP), exclusive of I and P frames from any other GOP, upon initiation of a reverse play command; and

means for displaying video images from the first GOP in the reverse time sequence, including:

means for decoding any bidirectionally predictively encoded frames (B-frames) using the stored I-frames and P-frames and for displaying the B-frames as they are decoded;

means for displaying the stored I-frames and P-frames of the first GOP as they are encountered in the reverse time sequence; and

means for decoding and storing I-frames and P-frames from a second GOP, exclusive of I and P frames from any other GOP, following the first GOP in the reverse time sequence, while the means for displaying the stored I-frames and P-frames displays respective ones of the I-frames and the P-frames of the first GOP;

wherein the means for displaying begins displaying frames from the first GOP before decoding any frame from the second GOP.

9. (Previously Presented) Apparatus according to claim 8 wherein:

the means for decoding and storing the I-frames and P-frames includes means for downsampling the decoded I-frames and P-frames to produce respective downsampled I-frames and P-frames and means for storing the downsampled I-frames and P-frames;

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the means for decoding the B-frames includes filtering means for filtering the decoded B-frames to display a reduced-resolution image; and

means for displaying the I-frames and the P-frames includes upsampling means for upsampling the stored downsampled I-frames and P-frames to provide respective reduced-resolution images for display.

10. (Currently Amended) A computer-readable carrier including computer program instructions that cause a computer to perform a method of displaying an MPEG coded compressed video signal in a reverse time sequence, the method comprising the steps of:

retrieving a first group of pictures (GOP) upon initiation of a reverse play command, the retrieved first GOP being the GOP displayed immediately preceding the command;

decoding any I-frames and P-frames of the first GOP, exclusive of I and P frames from any other GOP, and storing them in a memory;

displaying the decoded I-frames and P-frames of the first GOP as the I-frames and P-frames are encountered in the reverse time sequence;

decoding and displaying any B frames of the first GOP as the B-frames are encountered in the reverse time sequence; and

decoding I-frames and P frames of a second GOP, exclusive of I and P frames from any other GOP, and storing the decoded I-frames and P-frames of the second GOP in the memory, the second GOP being the next preceding GOP, wherein each I-frame and P-frame of the second GOP is decoded while a respective one of the I-frames and P-frames of the first GOP are being displayed;

wherein the computer program instructions control the display of frames from the first GOP to begin prior to the decoding of any frame from the second GOP.